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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/649,958

08/28/2003

Mohamad A. Shaheen

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7590

07/27/2005

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EXAMINER

WILSON, CHRISTIAN D

ART UNIT

PAPER NUMBER

2891

DATE MAILED: 07/27/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/649,958

Applicant(s)

SHAHEEN ET AL.

Examiner

Christian Wilson

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 13 May 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,3-5,7-19,21-23,25-29,31-33,35-47,49-51 and 53-56 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,3-5,7-19,21-23,25-29,31-33,35-47,49-51 and 53-56 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 13 May 2005 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Official Notice

1. Official notice is taken of the following material properties:

Band gap energy (E_g) of silicon (Si) = 1.12 eV

Band gap energy (E_g) of silicon germanium (SiGe) < 1.00 eV

These properties were taken from Sze (*Physics of Semiconductor Devices*, pg. 850) and

People (*Physics and Applications of Ge_xSi_{1-x}/Si Strained-Layer Heterostructures*, Figures 10 and 11).

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 1, 5, 7, 8, 19, 23, 25, 29, 31 – 33, 35, 36, 47, 49 – 51, and 53 – 56 are rejected under 35 U.S.C. 102(b) as being anticipated by Henley *et al.*

Henley *et al.* (US 6,290,804) discloses a method comprising impinging laser energy [column 7, line 17] on a substrate 10 and effecting laser-induced cleaving of the substrate [column 7, line 14] by stoichiometrically designing a composition of the material to substantially match a bond breaking energy involving the material to the laser energy and selecting the

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predetermined laser energy to match the bond-breaking threshold energy of the material [column 3, lines 35-55].

Regarding claim 5, Henley *et al.* further discloses the laser energy induces selective bond breaking at an interface of the host material of the substrate and the predetermined material to effect cleaving along the interface [column 4, lines 50-55].

Regarding claim 7, Henley *et al.* further discloses balancing the stoichiometric composition of the material to the laser energy to effect a cleave yield [column 3, line 50].

Regarding claim 8, Henley *et al.* further discloses bonding the substrate to a receiving substrate prior to cleaving where the cleaved layer remains bonded to the substrate [column 9, lines 25-40].

Regarding claim 19, Henley *et al.* further discloses impinging the laser energy on the side edge of the substrate [Figure 7].

Regarding claim 23, Henley *et al.* further discloses the laser energy induces selective bond breaking at an interface of the host material of the substrate and the predetermined material to effect cleaving along the interface [column 4, lines 50-55].

Regarding claim 25, Henley *et al.* further discloses balancing the stoichiometric composition of the material to the laser energy to effect a cleave yield [column 3, line 50].

Regarding claim 28, Henley *et al.* further discloses bonding the substrate to a receiving substrate prior to cleaving where the cleaved layer remains bonded to the substrate [column 9, lines 25-40].

Regarding claims 29, 31 – 33, 35, 36, 47, 49 – 51, and 53 – 56, Henley *et al.* discloses a silicon-on-insulator device in an electronic package [column 1, lines 15-25]. It is noted that product-by-process claims are not limited to the manipulations of the recited steps, only the structure implied by the steps. “[E]ven though product-by-process claims are limited by and

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defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process.” In re Thorpe, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985)

Since the recited structures are the same as the product as disclosed by Henley *et al.*, the claims is unpatentable over Henley *et al.*

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 3, 4, 21, and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Henley *et al.* in view of Roche.

Henley *et al.* further teaches a silicon substrate [column 3, line 61] and a predetermined material which is hydrogen [column 4, line 35], but does not discuss a predetermined material which is germanium or a laser with an energy greater than the band gap of SiGe or smaller than Si or is infrared. Roche (US 2003/0162367) teaches a Nd:YAG laser which is an infrared laser with an energy of 1.06 eV and a Ge material [0065, 0026]. It would have been obvious to one of ordinary skill in the art to use the laser and material of Roche since Roche teaches that the laser and material provides short pulses which are absorbed in the weakened zone of the material.

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6. Claims 9 – 12, 15 – 18, 37 – 40, and 43 – 45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Henley *et al.* in view of Kelly *et al.*

Regarding claims 9 – 11, Henley *et al.* teaches laser-induced cleaving but does not discuss plural interfering laser beams with specifically tuned energies that forms a interference profile. Kelly *et al.* (US 6,740,604) teaches a multiple laser cleaving method with simultaneous laser irradiation with plural interfering laser beams [column 3, lines 55-60]. It would have been obvious to one of ordinary skill in the art to use the laser method of Kelly *et al.* in the method of Henley *et al.* since the interfering beams produces an increase in the local radiation.

Regarding claim 15, Henley *et al.* further teaches the laser energy induces selective bond breaking at an interface of the host material of the substrate and the predetermined material to effect cleaving along the interface [column 4, lines 50-55].

Regarding claim 16, Henley *et al.* further teaches stoichiometrically designing a composition of the material to substantially match a bond breaking energy involving the material to the laser energy and selecting the predetermined laser energy to match the bond-breaking threshold energy of the material [column 3, lines 35-55].

Regarding claim 17, Henley *et al.* further teaches balancing the stoichiometric composition of the material to the laser energy to effect a cleave yield [column 3, line 50].

Regarding claim 18, Henley *et al.* further teaches bonding the substrate to a receiving substrate prior to cleaving where the cleaved layer remains bonded to the substrate [column 9, lines 25-40].

Regarding claims 37 – 40 and 43 – 45, Henley *et al.* teachess a silicon-on-insulator device in an electronic package [column 1, lines 15-25]. It is noted that product-by-process claims are not limited to the manipulations of the recited steps, only the structure implied by the steps. “[E]ven though product-by-process claims are limited by and defined by the process,

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determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process.” In re Thorpe, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985)

Since the recited structures are the same as the product as disclosed by Henley *et al.*, the claims is unpatentable over Henley *et al.*

7. Claims 13, 14, 41, and 42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Henley *et al.* and Kelly *et al.* as applied to claim 12 above, and further in view of Roche.

Henley *et al.* further teaches a silicon substrate [column 3, line 61] and a predetermined material which is hydrogen [column 4, line 35], but does not discuss a predetermined material which is germanium or a laser with an energy greater than the band gap of SiGe or smaller than Si or is infrared. Roche (US 2003/0162367) teaches a Nd:YAG laser which is an infrared laser with an energy of 1.06 eV and a Ge material [0065, 0026]. It would have been obvious to one of ordinary skill in the art to use the laser and material of Roche since Roche teaches that the laser and material provides short pulses which are absorbed in the weakened zone of the material.

Regarding claims 41 and 42, Henley *et al.* teachess a silicon-on-insulator device in an electronic package [column 1, lines 15-25]. It is noted that product-by-process claims are not limited to the manipulations of the recited steps, only the structure implied by the steps. “[E]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process.” In re Thorpe, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985)

Since the recited structures are the same as the product as disclosed by Henley *et al.*, the claims is unpatentable over Henley *et al.*

8. Claims 26 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Henley *et al.* in view of Nakano *et al.*

Henley *et al.* teaches an ion implantation method with hydrogen which forms micro-defects at the cleave plane [column 4, lines 60-65], but does not discuss forming micro-voids. Nakano *et al.* (US 2003/0153162) teaches an implantation method which forms micro-voids [0024]. It would have been obvious to one of ordinary skill in the art that the method of Henley *et al.* would produce the micro-voids of Nakano *et al.* at the cleave plane since Nakano *et al.* teaches that ion implantation causes micro-voids by channeling of ions in the material layer [0047].

Response to Arguments

9. Applicant's arguments filed May 13, 2005 have been fully considered but they are not persuasive.

Regarding claim 1, applicant argues that Henley teaches selecting the energy level of the laser to match the bond breaking strength of the cleaved material. Applicant argues that selecting the energy level of the laser is not the same as selecting the laser wavelength. It is well known in physics (as described by Planck's formula) that the energy of any electromagnetic radiation is described by the formula:

$$E = hc / \lambda$$

where h is Planck's constant, c is the speed of light, and λ is the wavelength of the light. Therefore, selecting the energy of the laser light is equivalent to selecting the wavelength of the light. Further, applicant argues that does not select the laser wavelength of the light based on the

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stoichiometry of the cleaved material. Webster's defines stoichiometry as "the quantitative relationship between constituents in a chemical substance". In Henley *et al.*, the bond breaking energy of the laser light is directly related to the quantitative relationship of the constituents of the cleaved substance [column 3, lines 50-60]. Therefore, the laser light wavelength is matched to the stoichiometrically designed cleave layer [column 4, lines 50-65] in order to more effectively cleave the substrate material.

The arguments regarding claims 9 – 18 are moot in light of the new grounds of rejection.

Conclusion

10. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Christian Wilson whose telephone number is (571) 272-1886. The examiner can normally be reached on weekdays, 7:30 AM to 4 PM.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bill Baumeister can be reached on (571) 272-1722. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

A handwritten signature in black ink, appearing to read 'CDW', is positioned above the printed name and title of the examiner.

Christian Wilson, Ph.D.
Primary Examiner
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CDW